

WHAT IS CLAIMED IS:

1. A method for manufacturing a magnetic field detecting element consisting of a soft magnetic core formed on a semiconductor substrate; a first and a second coils arranged on an upper and a lower parts of the soft magnetic core, and having a plurality of coil lines, respectively,
5 the method comprising the steps of:

forming a seed film of a predetermined thickness on the semiconductor substrate;

removing the seed film using a predetermined pattern so that a plurality of the coil lines constituting the first coil that would be formed on the seed film may be partitioned each other;

10 forming a first plating mold having a plurality of grooves that corresponds to the predetermined pattern, on an upper part of the seed film;

forming a plurality of the coil lines constituting the first coil by filling up metal in the groove of the first plating mold;

forming a soft magnetic core and the second coil on an upper part of the semiconductor
15 substrate where the first coil is formed; and

cutting off four edges of the semiconductor substrate so that a plurality of the coil lines partitioned by the predetermined pattern may be insulated each other.

2. The method according to claim 1, wherein the step of removing the seed film further

comprises the steps of: spreading a photoresist on an upper surface of the seed film; forming a predetermined pattern that would be removed, by exposing and developing the photoresist; and etching the seed film according to the pattern.

5 3. The method according to claim 1, wherein metal is filled up in the groove of the first plating mold by means of an electric plating.

4. The method according to claim 1, wherein the step of forming the soft magnetic core further comprises the steps of:

10 performing planarization of an upper surface of the semiconductor substrate on which the first coil is formed;

 spreading an insulating film on an upper surface of the semiconductor substrate for which planarization has been performed;

 spreading a soft magnetic material film on an upper part of the insulating film;

15 forming a pattern of the soft magnetic core through exposing and developing processes after spreading a photoresist on the soft magnetic material film; and

 etching the soft magnetic material film according to the pattern.

5. The method according to claim 1, wherein the step of forming the soft magnetic core

further comprises the steps of:

removing the first plating mold;

spreading an insulating film at a height higher than a height of the first coil, on an upper part of the semiconductor substrate from which the first plating mold has been removed;

5 spreading a soft magnetic material film on an upper part of the insulating film;

forming a soft magnetic core pattern through exposing and developing processes after spreading a photoresist on the soft magnetic material film; and

etching the soft magnetic material film according to the pattern.

10 6. A method for manufacturing a magnetic field detecting element consisting of a soft magnetic core formed on a semiconductor substrate; and a first and a second coils arranged on an upper and a lower parts of the soft magnetic core, and having a plurality of coil lines, respectively, the method comprising the steps of:

forming a first seed film of a predetermined thickness on the semiconductor substrate;

15 removing the first seed film using a predetermined first pattern so that a plurality of coil lines constituting the first coil that would be formed on the first seed film may be partitioned each other;

forming a first plating mold having a plurality of grooves that corresponds to the predetermined first pattern, on an upper part of the first seed film;

forming a plurality of coil lines constituting the first coil by filling up metal in the groove of the first plating mold;

forming a soft magnetic core on the semiconductor substrate where the first coil is formed;

5 forming a second insulating film on the semiconductor substrate where the soft magnetic core is formed;

forming a second seed film on an upper surface of the second insulating film;

removing the second seed film using a predetermined second pattern so that a plurality of coil lines constituting the second coil that would be formed on the second seed film may be
10 partitioned each other;

forming a second plating mold having a plurality of grooves that corresponds to the second pattern, on an upper part of the second seed film;

forming a plurality of coil lines constituting the second coil by filling up metal in the groove of the second plating mold; and

15 cutting off edges on four sides of the semiconductor substrate so that a plurality of the coil lines constituting the first and the second coils partitioned by the first and the second patterns may be insulated each other.

7. The method according to claim 6, wherein metal is filled up in the grooves of the first

and the second plating molds by means of an electric plating.

8. The method according to claim 6, wherein the step of forming the soft magnetic core further comprises the steps of:

5 performing planarization of an upper surface of the semiconductor substrate on which the first coil is formed;

spreading a first insulating film on an upper surface of the semiconductor substrate for which planarization has been performed;

spreading a soft magnetic material film on an upper part of the first insulating film;

10 forming a soft magnetic core pattern through exposing and developing processes after spreading a photoresist on the soft magnetic material film; and

etching the soft magnetic material film according to the pattern.

9. A method for manufacturing a magnetic field detecting element including the steps of:

15 forming a first coil on an upper part of a semiconductor substrate; after forming a soft magnetic core on an upper part of the first coil with an insulating film intervened, forming a second coil on an upper part of the soft magnetic core with another insulating film intervened, the method comprising the step of:

after forming a well of a predetermined dept on the semiconductor substrate, arranging

the first coil in an inside of the well lest the first coil should be projected to a surface of the semiconductor substrate.

10. A method for manufacturing a magnetic field detecting element comprising the steps

5 of:

preparing a semiconductor substrate;

forming a well of a predetermined dept on the semiconductor substrate;

forming a first coil consisting of a plurality of coil lines in an inside of the well of the semiconductor substrate;

10 forming a first insulating film on an upper part of the semiconductor substrate including the well;

forming a soft magnetic core on an upper part of the first insulating film;

forming a second insulating film on an upper part of the first insulating film including the soft magnetic core; and

15 forming a second coil that corresponds to the first coil, on an upper part of the second insulating film.

11. The method according to claim 10, wherein the well is formed in such a way that the well has an inclined sidewall that is gradually inclined in its inside from its upper part to its bottom

by the etching process.

12. The method according to claim 10, wherein the step of forming the first coil further comprises the steps of:

- 5 forming a first seed film on a surface of the well;
- forming a first plating mold having a plurality of grooves on the first seed film;
- forming a plurality of coil lines constituting the first coil by filling up metal in each groove of the first plating mold; and
- removing the first plating mold and the first seed film under the first plating mold.

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13. The method according to claim 12, wherein metal is filled up in each groove of the first plating mold by means of an electric plating.

14. The method according to claim 10, wherein the step of forming the second coil further
15 comprises the steps of:

- forming a via hole by etching the first and the second insulating films on both sides of the soft magnetic core;
- forming a second seed film on an upper surface of the second insulating film on which the via hole is formed;

forming a second plating mold having a plurality of grooves, on the second seed film;

forming a plurality of coil lines constituting a second coil by filling up metal in each groove of the second plating mold, and connecting the first coil with the second coil through the via hole; and

5 removing the second plating mold and the second seed film under the second plating mold.

15. The method according to claim 14, wherein metal is filled up in each groove of the second plating mold by means of an electric plating.

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16. The method according to claim 10, further comprising the step of forming a protection film for protecting structures including the second coil.

17. A magnetic field detecting element comprising:

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a semiconductor substrate;

a soft magnetic core formed on an upper part of the semiconductor substrate;

an insulating film positioned on an upper and a lower parts of the soft magnetic core; and

a first and a second coils formed in such a way that those coils enclose the soft magnetic core with the soft magnetic core and the insulating film intervened, and having a plurality of coil

lines, respectively,

wherein a well of a predetermined dept is formed on the semiconductor substrate and the coil lines constituting the first coil are arranged in an inside of the well.

5 18. The element according to claim 17, wherein a height of the coil lines and a dept of the well are the same.

10 19. The element according to claim 17, wherein the first coil is positioned at a lower part of the soft magnetic core and the second coil is positioned at an upper part of the soft magnetic core, and the coil lines of the first and the second coils are connected by means of a third coil filled in the via hole formed by passing through the insulating film on both sides of the soft magnetic core.

15 20. The element according to claim 17, wherein the well has an inclined sidewall that is gradually inclined in its inside from its upper part to its bottom.